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ABSTRACT

Designed to assist secondary and post-secondary educators develop community interactive science programs, this manual describes steps undertaken at New Mexico's Albuquerque Technical Vocational Institute to develop pre-college medical science programs that encourage local high school students to consider the college's medical technology program. First, an introduction provides a general description of the pre-college programs and sample comments from program participants. The second part summarizes program objectives from 1994-95 and 1995-96 and indicates that 6 students were served in 1994-95 and 13 in 1995-96. The third part focuses on beginning the process of developing a program, discussing issues related to funding, preparing the proposal, costing out the proposal, hiring support staff, budgeting for contracted services and teachers' salaries, and buying supplies. The fourth part discusses specific considerations in project development related to establishing academic requirements, administrative needs, scheduling and school calendars, student attendance, student activities, ancillary services, developing syllabi, and ordering and storing materials and perishable supplies. The final sections review drawbacks to relying on donations, ideas for organizing guest speakers and field trips, and methods for handling public relations and outreach. Appendixes provide sample course syllabi, examples of program pre- and post-tests, and a sample program abstract used to publicize the project. (HAA)

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Developing a Community Based Pre-College Medical Science Collaborative

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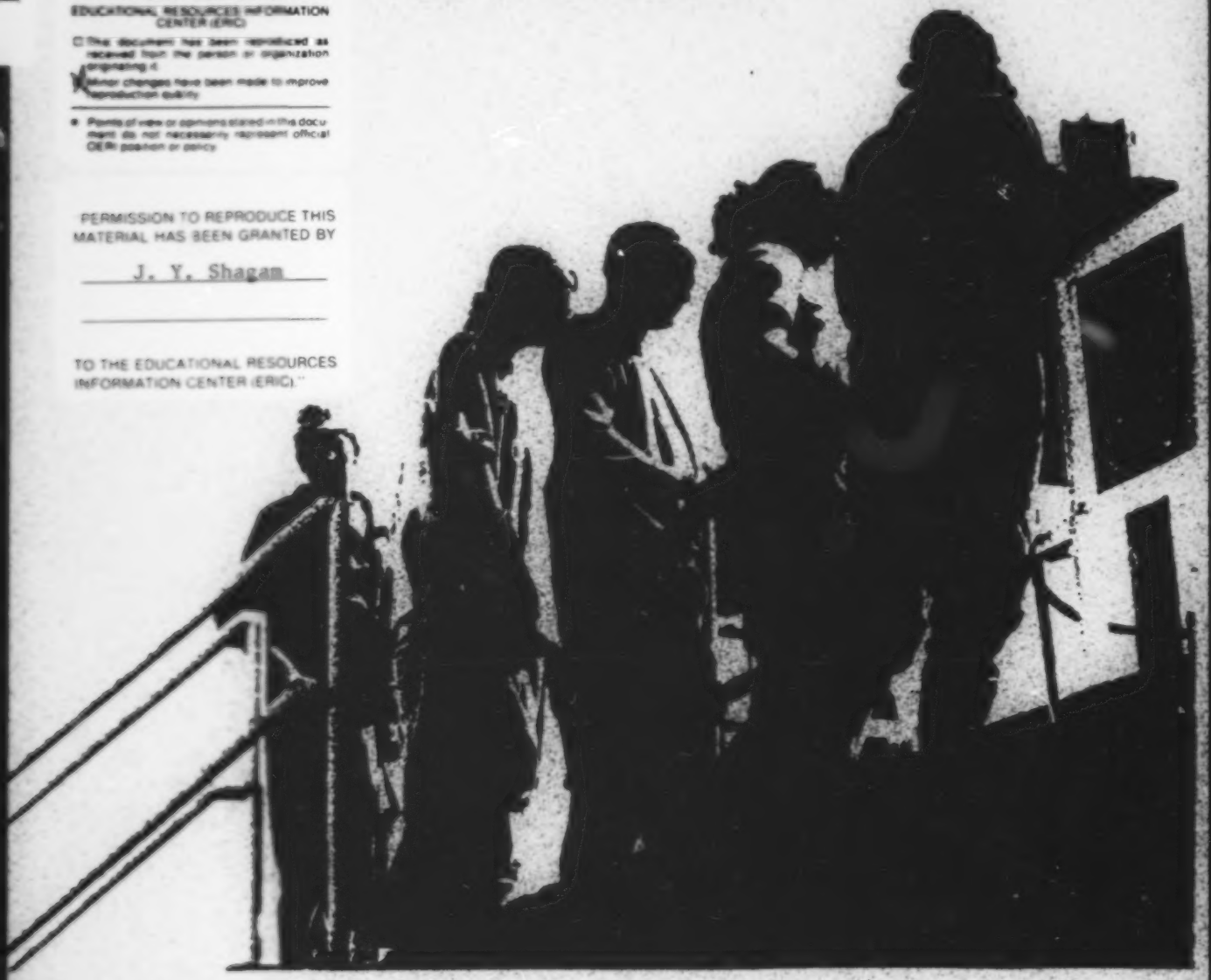

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TVI
COMMUNITY
COLLEGE

September 10, 1996

Dear Colleaques;

This is a manual written by a community college faculty member for other secondary and post-secondary educators interested in the development of community interactive science programs. The information in the manual is based on personal experience and has proved to work well in my particular circumstances.

It has been personally satisfying to take an idea from the point of inception, molding it to make it acceptable for funding and finally reshaping it to accommodate the needs and requirements of impacted institutions. Rather than considering this process full of obstacles and dead ends, think of it as a dynamic exercise in creative problem solving.

I hope that this manual will help to inspire the development of many new and creative programs that will eventually benefit our students and our communities.

Sincerely;

Janet Yagoda Shagam

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Introduction

This "how to" manual has been written in response to requests from other educators and scientists interested in starting pre-college programs in their communities. Topics covered will include: finding the right funding, writing the funding proposal, working with the high school, administrative guidelines and course syllabi and special considerations when working in a high school environment.

The pre-college project was part of a larger proposal to increase collaborative efforts for Tech Prep education between Albuquerque Technical Vocational Institute (TVI), a community college in Albuquerque, New Mexico, and the Albuquerque Public Schools. Highland High School (HHS) was chosen as the host school for the program because of its close location, interest in the project and conformity with certain grant stipulated requirements.

The 1994-1995 Perkins pre-college grant was specifically designed to encourage high school students to consider the Medical Technology program at TVI as their post-secondary option. The 1995-1996 grant was broader in its intent and encouraged student interest in all Allied Health Science programs offered at TVI. Both programs emphasized "hands on" learning, high school preparation for entry into post secondary studies, high teacher to student ratio, exposure through guest speakers and field trips to a wide range of science based/health related professions, various personal and public health issues and the requirement to work on a self-directed research project. Language and economically disadvantaged students were recruited and encouraged to register in this class. However, all HHS students meeting the prerequisites were welcome to register.

The more than two years spent on the Perkins Pre-College Medical Science programs have been personally satisfying and time well spent. I have been able to work with people throughout my institution and public school system. I have learned about the inner workings of both organizations, have improved my administrative skills, and have hopefully established a rapport that will permit the development of other interactive projects. This has definitely been a "win-win" and a "learn-learn" situation.

General Description of the Pre-College Medical Science Programs

Students in the PCMS programs met for a 90 minute block 5 days a week. Class instructors included myself, a HHS biology teacher, and for the 1994-95 project, the TVI Medical Technology director and an ESL aide. The Monday and Friday classes (HHS biology teacher), emphasized technical writing, math, computer, measurement, library research and graphing skills. The rest of the week was devoted to lecture and hands on lab activities. Field trips and guest speakers, scheduled throughout the week, emphasized skills needed in the workplace, educational preparation as well as the expected requirement for continuing education. Speakers discussed personal paths to their current position, public health issues, employability, salaries, a typical day, career advancement and career changes. When possible students were given job related "hands on" activities. We had 1 or 2 guest speakers per month and 2 field trips per semester.

The course content for the 1994-1995 program included lab safety, aseptic technique, hospital practice, medical microbiology and related lab techniques, hematology, immunology, urine analysis and histology. An effort, both in lab and lecture, was made to increase awareness of various consumer and personal health issues. The 1995-1996 class was expanded to a full year and was rounded out with the addition of anatomy and physiology curricula.. Students, either as individuals or in groups, did independent lab research projects. The projects were exhibited i:. the school science fair and many progressed to the Regional Science and State Fairs.

Many different tools were used to assess the program. Students were given pre and post tests as well as surveys throughout the semester. Their grades were based on lecture exams, lab reports, research reports, a lab practical and an improvement factor based on the pre and post exam results. Appropriate faculty and administrators also participated in the survey process. These results were summarized and discussed in the Perkins final report.

Students in the Perkins programs received high school credits in science and technical writing. A certificate of participation from TVI was presented to each student during the awards assembly at the end of the year.

Examples of Student Comments

"I really enjoy this class and I'm really glad that I got an opportunity to take a class like this before I graduated. Most kids that go into other fields get really good classes and most science classes are a bunch of notes. This is the first class that has really allowed me to open my eyes in the areas of science."

"I have learned of things I have never heard of before."

"I don't like the smell when I walk in from lunch."

"I learn more from hands-on than from reading."

Favorite things about the class: field trips, guest speakers, hands on lab work, gross pictures from the Office of the Medical Investigator, freedom and respect.

Perkins Pre-College Medical Science Summaries

1994-1995 Objectives

The Pilot Demonstration Associate Degree Prep Program for Medical Technology (ADP-MT) is a part of a larger Perkins proposal to increase collaborative efforts for Tech Prep (ADP) between APS and T-VI. The purpose of the ADP-MT program is to encourage language and economically disadvantaged students at Highland High School (HHS) to consider careers in Medical Technology and to apply to the Medical Technology Program at T-VI. The project has initiated or increased collaboration between APS and T-VI science and ESL faculties, administration and curriculum committees. In addition our exposure to special population high schools students, has made us more aware of their needs. Hopefully we will be better able to accommodate them when they become students at T-VI.

Completion of following tasks demonstrate that we have met our project objectives.

- Set up administrative guidelines, develop student presentation and obtain curriculum approval for the MTP program.
- Present the MTP program to students at Highland High School.
- Select students to participate in the MTP program.
- Student participation in the MTP program.
- Analyze data derived from surveys.
- Produce a successful program that can be expanded to other high schools and directed toward other degree programs in Applied Health Sciences at T-VI.

Departures from original project plan include:

- Addition of technical writing to the core program;
- Schedule of class during 6th and 7th periods Monday through Friday;
- Above schedule, necessary due to room and teacher constraints, prevented many students from taking the class; and
- Students are being exposed to careers in Forensic Science, Public Health, Hematology, Respiratory Therapy, Emergency Medical Technology and Nursing in addition to Medical Technology.

Changes in staff personnel include:

- Use of an ESL aide rather than an ESL teacher in class;
- HHS biology teacher assigned as a co-teacher during 2 period block; and
- Use of Vietnamese ESL aide only - Spanish speaking students did not require ESL services.

We had 11 students apply for the program. Seven students registered for the program and we currently have six students actively participating in the class. The students who did not register for the class were unable to do so because of conflicts with home responsibilities or after school sports. In one case there was concern voiced by one parent that the program would be too tiring for his handicapped daughter. The one student who dropped after two weeks participation indicated home responsibilities prevented her staying at school until 3:30 PM. It has become clear to us that many of our potential and registered students are expected by their families to modify their school schedule to accommodate home responsibilities and work. Many of these special population students are not able to make school their first priority.

Special Population Students* Served by the ADP-MT Program

Ethnicity	Male	Female	Limited English Proficiency	Economically Disadvantaged	Educationally Disadvantaged
Hispanic	2	2	3	4	1
Black	1				1
Vietnamese		1	1	1	

*Number of students served is 6

Served students are reported as duplicated counts. Each student appears in all applicable categories.

1995-1996 Objectives

The Pilot Demonstration Associate Degree Prep Program for Pre-College Medical Science Program (PCMS) is a part of a larger Perkins proposal to increase collaborative efforts for Tech Prep (ADP) between APS and T-VI. The purpose of the PCMS program is to encourage language and economically disadvantaged students at Highland High School (HHS) to consider careers in applied health sciences and to apply to such programs at T-VI. The project has initiated and increased collaboration between APS and T-VI science faculties, administration and curriculum committees. Much of the material developed for the PCMS program will be incorporated into the new "block" program that will be started at HHS Fall 1996.

Completion of the following tasks demonstrate that we have met our project objectives.

- Set up administrative guidelines, develop student presentation and obtain curriculum approval for the PCMS program.
- Student registration for the program.
- Student participation in the PCMS program.
- Analyze data derived from surveys.
- Produce a successful program that can be further implemented at HHS and directed toward other degree programs in Applied Health Sciences at T-VI.
- Presentation of findings to the Pre-College Education section of the National Society for Microbiology Meeting, New Orleans, May 1996.

Departures from original project plan include:

- Expansion of the class from a one semester class to a full year class.
- Addition of Anatomy and Physiology to the program.
- Field trips to the Water Treatment Facility, Bueno Foods, UNM Bone Lab, Albuquerque Wetlands Demonstration.

Changes in staff personnel:

- No changes

Students Served:

The PCMS class started with an initial registration of 18 students. By the second week of school 5 students dropped due to schedule conflicts or the need to take required classes for graduation. By mid-semester 1 student moved to Georgia and in November a transfer student from St. Pius High School entered the PCMS class. A description of the Special Populations Served is summarized below.

Special Population Students* Served by the ADP-PCMS Program

Ethnicity	Male	Female	Limited English Proficiency	Economically Disadvantaged	Educationally Disadvantaged
White	3	4	0	6	6
Black		1	0		
Hispanic	1		0	1	1
Native American	2		0	2	2
Vietnamese	1		0	1	1
Asian Indian	1		0	1	1

*Number of students served is 13

Served students are reported as duplicated counts. Each student appears in all applicable categories.

The Special Population Students served in the 1995-1996 PCMS program represent many different ethnic groups. This group of students represent economically and educationally disadvantaged, rather than limited English proficiency situations. Several of the students are multi-lingual. Fluency in one or more of the following languages is represented in the class: Vietnamese, Navajo, Hindi, Pharisee, French, Arabic, Spanish and German. Their fluency in many languages is due to: languages other than English spoken at home, having lived in many different countries and/or having lived in the United States for more than 5 years.

Getting the Process Started

Once your idea starts to take shape, you need to establish philosophical support and interest from administration. It is absolutely imperative that an administrator from both the home institution and the host school want the idea to work. It is at this level of authority that helpful decisions can be made that will support atypical schedules, room and teacher assignments, allocation of money and other matters related to the implementation of your idea. An intrigued administrator will make things happen for you.

The high school administrator (principal or vice-principal for instruction) can schedule an open meeting at the high school with science faculty, counselors and other ancillary personnel potentially affected by the project. This is the time to publicly exhibit your ideas and ask for input. It is import that high school personnel understand they can choose to play an active role in the design and implementation of the project.

Now you are ready to take your grand ideas and mold them to grant defined constraints.

Sources of Funding

There are plenty of funding sources - the trick is to find the right ones. Granting organizations explicitly, and very narrowly define, who and what they will fund. Therefore, you need to find a fund that comes close to meeting your needs/time frame and then tailor your ideas to meet their specifications. It can also be of benefit to browse the grants literature and let the description of the grant inspire ideas for funding.

Sources of funding can be found in your Research and Development office, various data bases and through various professional organizations. Sometimes it gets real easy and requests for proposals may show up in your mail box.

Organizations that often provide funding for science education can include: professional memberships, National Science Foundation, National Institutes of Health and the various moneys allocated by governmental bodies. Local or regional sources of funding can include: industry, small business, National Laboratories, foundations and civic minded individuals. Many industries are required, by the Bond and Taxation incentives that brought them to the community, to provide local funding for education. A call and a follow-up letter to the Educational Outreach or the Public Relations offices can put you in touch with the right people within that industry.

The Proposal

The funding organization will define the form and format of the proposal. The proposal is written either by answering specific questions in the proposal package or as a letter to the organization. One should be very careful to follow the prescribed format exactly as stated and to adhere to all date and copy number requirements.

Whether you write the proposal for NSF or to a local organization, your potential benefactor must clearly understand why you need the money - how it will be spent and who will benefit from the project. Most of the following line items will need to be carefully described in the proposal:

- Why is your idea needed;
- Project goals/objectives;
- Demonstration that the project will be of sufficient scope, size and quality to be effective;
- Timeline;
- Strategy for implementation;
- Impact;
- Methods used to assess project;
- Administrative duties;
- Administrative guidelines; and
- Cost benefit analysis.

Without question, many of these items will be modified as the grant is written and the various elements of the project fall into place. Should you receive funding, the proposal is the guide for all program activities and is a statement of commitment/agreement between you and the source of funding.

Because it is unrealistic to expect that all elements of the proposal can be followed exactly as stated, the accepted proposal is the reference point for all departures from the original plan. Depending on the stipulations of the grant, you may have to petition to make certain changes. Generally prior permission is needed to spend money differently than originally stated. Be sure to document all departures from the original plan as they will need to be included and explained in the final report.

Costing out the Proposal

The actual forms or format needed to cost out the project will be provided by the granting organization. It is important to fill out these forms completely and accurately. The granting organization must clearly understand why you need funding as well as where and when those funds will be spent. A low cost, obviously underestimated grant, will not increase the likely hood of getting funded. Under funded projects are less likely to meet stated outcome objectives. Be sure to indicate if you are eligible for matching funds or if you are writing this grant in tandem with other proposals.

Your home institution can help you with the various factors needed to estimate costs for personnel and contracted services. The cost of supplies is determined by the course syllabus and the materials needed to support your program.

Support Staff

Support staff may be needed to: order supplies, prep for labs, Xerox readings, manage the transferal of money between college and public school offices, work out contracts for waste removal, contract payment for support services as well as other financial management duties. Remember - your job is to teach and administer the project. Make sure that you have budgeted enough hours for appropriate support staff (lab technician(s), secretarial and business office) to take care of these important issues.

The funds needed to support a lab technician can be determined by estimated support hours needed, the hourly wage, cost of benefits and anticipated salary increases for the following year. The business office of your home institution can help with these factored values. However, it is a good idea to over-estimate anticipated hours by 5-10% to accommodate unexpected changes in salaries or hours needed. You will also need to find out from your business/personnel office if these hours can be assigned to a current employee or if the job must be posted.

The cost of office and secretarial services are usually defined by the institutional overhead rate or by the granting organization's standard overhead rate.

Contracted Services

You may need to budget for and have accounts set-up to pay people for services such as:

- Medical/biological waste removal;
- Extra hours for team teacher;
- Cost of substitutes for college teacher professional leave;
- Transportation to field trip sites;
- Teachers aide for ESL or Special Education students; or
- Photographic services.

Funds for contracted services are based on estimates from potential vendors. Eventually funds allocated for contracted services will be transferred from your home institution to various contracted vendors. You may be limited to an approved list of vendors or required to go through a bidding process for services.

College Teacher's Salary

The cost of your salary is the cost of your teaching replacement or for supplementary salary needed to support your extra work load. Be sure to include anticipated raises for the following academic year and the cost of benefits. These costing factors can be found in the business office of your home department or institution.

Host School Teacher's Salary

No salary is needed for the host school teacher if work is consistent with the teaching contract. However, funds may be needed if the school must redistribute faculty work load due to participation in this program. Supplementary funds may also be required to pay for time needed outside of normal contract expectations.

Supplies

The cost of supplies is defined by the content of your program. To determine these costs make a list of all the items needed, their quantity and their prices. Be sure to put in a cushion of 10% to accommodate price increases and the cost of shipping.

Nuts and Bolts Considerations

The timeline that was part of your the proposal will guide through the order of tasks that will take your project through completion. Those tasks may include: development of recruitment and course materials, curriculum approval, contracting support services, ordering supplies, development of the syllabus and work schedule as well as execution of the actual program. However, keep in mind that actual work can not begin until the funding start date and/or when the funds have reached your institution.

Academic requirements

Academic requirements will vary with issues specific to the project. For the Perkins funded project it was necessary to get approval from the APS curriculum advisory committee for the syllabus and course number. This involved producing a document that demonstrated various state requirements would be met for course content and class hours.

It is also necessary to define prerequisites for the class. Because this program was developed to attract a wide range of students, minimal requirements were Junior status and having passed Biology or Chemistry with a C or better. However, even these requirements could be waived with a teacher or counselor recommendation.

Administrative Needs

To get a good student response to your program, one needs to establish a good working relationship with host school councilors, science teachers and club advisors. The science department in particular should understand that you are not trying to undermine existing classes by drawing students into your program. Assure them that your program will increase interest and participation science. Faculty interest and support will help to assure good enrollment.

Other "nuts and bolts" administrative tasks may include:

- Policy on mid-semester admission of transfer students;
- Accounts for contract services;
- Vendor accounts;
- Ultimate ownership of purchased supplies and equipment;
- Policy and need for biomedical waste storage and removal;
- Contract class load for host school teacher;
- Host school schedule and room assignment;
- Modifications to home institution teacher's contract; and
- Ancillary services such as ESL aide.

Scheduling and School Calendars

Get a copy of the school system and host school calendars when you start to develop the course syllabus. Use those calendars to plan in advance for local holidays, staff development day(s), school assemblies and abbreviated schedule day(s). Also be prepared to make immediate adjustments for snow days, fire drills and extra assemblies due to impending athletic state championships and other events requiring the attendance of the whole school in one room.

It is also necessary to compare your college contract calendar for conflicts with the public school calendar. For conflicted time; either arrange for your team/substitute teacher to take over, include funding for your additional teaching hours or don't worry about it and just "get the job done".

The design and implementation of your program is dependent on the type of class schedule present in the host school. In some schools classes meet once a day for a defined length of time (40 minutes, 50 minutes), other school may have a block schedule where classes may meet for 80 or 100 minutes or a rotating schedule where certain classes may meet for a longer blocks of time. Make sure the scheduling format at your host school is (or can be made) compatible with your home institution responsibilities and the requirements of your program.

Student Attendance and Motility

Unlike the college environment, teachers in the high school situation are more immediately responsible or accountable for the whereabouts of the students. It is expected that attendance be taken and reported daily and that students be on time for class. In some situations students may not enter a class late and must go to a holding area until the next bell. When possible, provide your students with an environment that supports/encourages responsible behavior and more closely resembles expected independence in the college situation. However, do keep in mind students may get in trouble if other faculty see them out of class without appropriate permission or a hall/bathroom pass.

Students in high school may have "excused or 'unexcused" absences. Excused absences may include field trips for other classes, appointments with school professionals, and injury incurred while participating in school sports. It is expected that students not be penalized for excused absences. However, it may not be clear as to who (teacher/student) is responsible to initiate the need to make-up missed work.

Unexcused absences are those that are due to excess absences resulting from illness, trips to non-school sponsored events or from truancy. It appears that in these situations make-up work is at the discretion of the teacher.

In an effort to make the pre-college program more like a college experience, students should be encouraged to notify you of expected absences (excused or otherwise) and to keep in touch with classmates for makeup work. Provide the students with your phone number or e-mail address, make them aware of your office hours at your home institution and have them exchange phone numbers with each other. Help them to become self sufficient and independent.

Like the college situation, students may disenroll from your class . High school students usually leave due to their family moving to another state or neighborhood. This may require that you provide documentation for the new school about their participation and work accomplished in your program. You should collect books and other materials that belong to the granted program or the school before they leave.

On the other hand, students may move to your host school area and enroll in your class! Unless previously stated in your administrative guidelines that you will not accept mid-semester students, you should expect to accommodate new students at any time.

Educationally Disadvantaged Students

"High risk" or "educationally disadvantaged" student populations may not have the luxury to consider school their first priority. Many of these students may work close to 40 hours a week outside of school and/or may have significant family responsibilities. The reality is, despite their motivation and interest, they do not have the time to study or do research outside of class and most do not have home computers. This is far from the optimal situation, but sadly enough these students have many of the same pressures as their re-entry adult counterparts. Therefore it is important to make the class as self contained as possible and give time within the classroom setting to do library research, work in the computer lab and to work in study groups.

Student Activities

Many students are involved in a wide assortment of school sponsored activities. These activities can include ROTC, orchestra, band, varsity sports, debate team or chess team. Students who participate in these programs often have excused absences to leave school for various lengths of time. These students should be encouraged to notify you beforehand of anticipated absences so they can better keep up with course work.

Ancillary Services

High schools offer a full range of "on site" or referred ancillary student support services. These services may include psychological counseling, speech and hearing, educational testing and evaluation, English as a Second Language as well as medical and dental support. Because specially funded programs tend to have increased teacher-student contact, you may observe or become aware of student problems that have been overlooked or ignored. Usually a referral to the appropriate office, a discussion with the student, or a few well placed phone calls will get things taken care of.

Teaching Credentials

If you do not have a secondary school teaching credential you may have to get permission to teach at the host institution on a temporary waiver, be part of a program that permits individuals with advanced degrees in the content area to teach in the public schools or team with a credential teacher. The school principal or vice-principal for instruction can indicate which might be the most efficient path.

Syllabus

The class syllabus is a document that includes a class description, grading requirements, e-mail/phone contacts and the schedule for class assignments and activities. The syllabus is a contract between the teacher and the student where commitment and responsibilities, on the part of both parties, become clearly defined. It is my opinion that mid-semester changes to the syllabus are not done for frivolous reasons and must be done with group consensus.

Students at HHS were not familiar with this mode of doing business. It took some time before they realized that the syllabus makes them directly responsible for themselves, the class and their performance.

An example of a class syllabus is included in Appendix A.

Ordering and Storage of Materials

Order materials through an account set up at your home institution. Public schools do not appear to have an easy or direct mechanism for faculty to order supplies. Keep the supplies at your home institution and deliver when needed. The laboratory prep area of your host school may have a very open-ended policy for use of materials. It is likely there will be no employee responsible for inventory, making reagents or cleanliness in the lab prep area. In many public schools the science chairperson orders and replenishes supplies once a year and teachers tend to grab what they can, when they can, for their classes.

Microbial Media and other Perishable Supplies

If possible have the lab technician make media and other reagents at your home institution. The host institution more than likely will not have a lab prep area that can support your needs. Making lab reagents at your home institution is usually the most cost and time effective situation and you have a much better chance that supplies will be available when needed. Make sure there is a refrigerator that can be used for temporary storage of these materials at the host institution. It is imperative that it is commonly understood that supplies in this refrigerator are not for general use. However, it helps to keep things friendly and cooperative if surplus plates and reagents are made available to other teachers at the host institution.

If it is neither possible nor cost effect to make microbial media they can be purchased pre-made through any medical or biological supply houses. It is usually worthwhile to purchase pre-made single use or exotic supplies. Make sure that you have an account set up with the vendor and that you know the time needed for delivery. If you live in an area with a large hospital(s) and/or a medical school, a distributor should be near by. If you can't find a supplier in the phone book, call the hospital purchasing agent or lab manager. They can either put you in touch with the right people, offer to purchase materials for you or donate materials to the program.

A Personal Philosophy on Donations

Do not depend on donated materials to support your program. First of all, it lowers the credibility and perceived quality of the project. Sure money is tight, but good proposals will eventually be funded. Looking for donations takes time that could be better used elsewhere. Donated supplies may not be first quality - past date, leaky or have been improperly stored. Your students deserve better and you have no control over the quality, quantity or the delivery dates for donated materials.

Same thing goes for donated equipment. It is dated and probably broken. Donated equipment does not come with the maintenance contract, so your institution will get stuck with large repair bills to maintain the old workhorse and/or you have added to the "doorstop collection". The donor has a tax deduction and you have a liability.

Guest Speakers and Field Trips

The heart of a community based PCMS program is the guest speakers and the field trips. It is in this part of the program that students are able to apply what they have learned in class to the real world, make some decisions concerning the role of education in their future, do some thinking about possible career choices, make contacts for summer jobs/mentorships and get an appreciation for the wide application of science to community services and business.

Although financial community support for high school programs is not difficult to obtain, one does not often see the community in the high school. Extending invitations to guest speakers helps to "put a face" on the high school, the neighborhood and the students.

Guest Speakers

Recruit your friends as guest speakers. The Public Relations or Educational Outreach offices of local business, industry or public facilities can also provide guest speakers. It is also worth while to "cold call", perhaps in response to a newspaper article, potentially interesting speakers.

Some contacts are experienced community speakers and will have materials ready for a presentation. Others, when you first approach them will be flattered, but will express disbelief they could be of interest to a high school audience. Many people are uncomfortable with the prospect of interaction with high school students. Assure them their material will be of interest, that it is a friendly group of students and give them a general format for the presentation. Suggest that they bring slides, instrumentation or other things that lend themselves to discussion or "hands on" activities.

Participating guest speakers in the Perkins program have been:

- Large and small animal veterinarians;
- Forensic Chemist from the Albuquerque Police Department;
- Intensive care neo-natal nurse;
- Respiratory therapist;
- Medical administrator;
- Medical technologist;
- Marine biologist;
- Emergency medical technician;
- Surgical assistant;
- Pathology assistant;
- Medical technologist from the Office of the Medical Investigator; and
- School nurse.

All speakers have indicated that they enjoyed the experience and would like to be invited back. Be sure to have the students send a note of thanks to each speaker.

Field Trips

Many potential field trip locations, do not allow non-employees under the age of 18 in their facility. If you explain that this group of students are participating in a specially funded program and have indicated a high interest in science, they may be willing to make an exception. Be sure to tell them that this small group of students will be accompanied by two teachers. Many organizations regularly host field trips from school groups and liability is not an issue for them.

The Yellow Pages and your friends are wonderful field trip resources.

PCMS field trips included:

- Albuquerque Waste Water Treatment Facility;
- City of Albuquerque Laboratories;
- Experimental Wetlands Demonstration Site;*
- TVI Cadaver Laboratory;
- University of New Mexico Forensic Anthropology Labs; and
- A chili manufacturing plant.

The goal of the field trips was to introduce students to the "real life' importance of excellence in science, math and oral/written communication skills. Students also made community contacts for potential summer jobs, mentorships and have a better appreciation how their community provides services and products.

Other sites worth considering for field trips and available in most communities are:

- Hospital laboratories;
- Pharmaceutical manufacturing sites;
- Medical appliance manufacturing sites;
- Quality control labs;
- Ultra clean manufacturing;
- Meat processing plants;
- Snack food manufacturing;
- Beer, wine, dairy, bread or cheese producers;
- USDA facilities;
- Military installations; and
- University facilities.

Transportation to field trip sites can be a problem. The method of transportation with the lowest liability are chartered busses. If the school is not able to provide bus service, it may be necessary to fund these trips with grant money. Public transportation and private vehicles may or may not be options depending on public school policy on such matters.

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* This field trip was made in conjunction with TVI Environmental Protection Technology students. This gave the HHS students an opportunity to interact with adult learners.

Public Relations and Outreach

Public awareness of your project is very important. The granting and community based organization(s) that have given support to your program need to be acknowledged. We all want to know that our tax dollar is being spent wisely and that local business support our schools. Public awareness of your programs helps to increase student participation, community support and interest as well as inspire the development of other worthwhile projects.

Publicity for the program can come from:

- Presentation to the high school parent organizations;
- School newsletter;
- Television or city newspaper coverage;
- Presentation at professional meetings;
- Presentation at school assemblies; and
- Public recognition for student participation.

Final Comments

This manual is by no means the final word on grantsmanships, program development or management. Hopefully it will help to: inspire creative projects; to avoid terrible administrative quagmires and to make a small contribution toward increasing community involvement in education.

I look forward to your questions or comments.

jshagam@tvi.cc.nm.us

Appendix A: Sample Course Syllabi

Highland Pre-Medical Science Program
Lab Portion
Fall Semester

Instructor:
Janet Yagoda Shagam, Ph.D. **Phone Number (TVI):** 224-3597

If I am not there, please leave a message on my voice mail. Because I share an office with several other people, be sure to state: my name, your name, a brief message and a phone number where you can be reached.

E-mail: Janetshaga@AOL.com

General:

I will be responsible for the Microbiology lecture and lab portion of the class. We will discuss basic principles of microbiology including types of microbes, emergent diseases, virulence and pathogenicity, food, waterborne, airborne and direct contact diseases. We will also discuss contemporary issues in microbiology such as antibiotic resistance, toxic shock syndrome, AIDs, hepatitis A/B as well as topics of local relevance such as Hantavirus, meningitis and plague. Please read and bring to class newspaper and magazine articles to increase our knowledge of local microbial events.

We are planning on several guest speakers and at least two field trips during the Fall semester.

Lab Safety:

Please come to class having read over the material for the lab experiments. This will help us to work efficiently and safely. Because we will be working with pathogenic (disease causing) organisms we must use sterile technique and dispose of waste in the appropriate place. It is also required that hands and the work area be washed before and after lab, that gloves be worn while working and that no food is brought into or consumed in the lab. Safety and sterile technique will be discussed at length during the appropriate class meetings.

Lab Portion:

We will learn: sterile technique, use of microscope and spectrophotometer, dilutions and calculations for plate counts, environmental sampling, Gram and spore stains, media inoculation techniques, use of selective/differential media, membrane filtration techniques, metabolic tests for microbial identification, reactions of *Strep* on blood agar, measurement of antibiotic resistance and use of scientific method in the completion of an original project.

Bring to Class:

Bound lab notebook - keep in your lab drawer
pencil
lab/reading handouts
lecture notebook
spiral note book - class journal
You will be provided with a labcoat and latex gloves

Grades:

Your grade in the lab/lecture portion of the class will be based on weekly quizzes, a lab practical exam, microbial unknown project, a lab project that maybe submitted to the science fair and participation.

Highland Pre-Medical Science Program

Cell and Microbiology Emergent Diseases

Week 1 August 14

Mon-Intro to class, survey forms, pre-test for cell and microbiology, science fair project
Tues- Measurement Lab, scientific notation and metrics
Wed. Continued, use of microscope and measurement
Thurs microscope and measurement of cells, bacteria, wet mount
Fri - Monday con't

Week 2 August 21
Monday/Friday Graphing, histograms, line graphs, interpretation, interpolation, extrapolation
T/W/R·Biological Molecules, Biological Molecules Lab

Week 3 August 28
M look up stuff in books about urine with high sugar and/or protein, maybe they could do their own sample, kidney physiology, diabetes,
T Medical technology program (Monya?) Urine testing with dip sticks, hospital samples
W Pipetting, dilutions, calculations, colored water
R- use of spectrophotometer, work on standard curve, unknown BSA biuret
F- work on data, write up a simple report

Week 4 Starts Tues Sept 5
T- lecture about different types of bacteria,
W- sterile technique and environmental sampling
R- Gram stains, spore stain, using environmental samples and lab specimens
F- staining continued, measure size of bacteria, convert units

Week 5 September 11
M- start reading Dancing Matrix
T- Sterile technique, pour, spread, streak plates, deeps, slants
W. observe
R Lecture on emergent diseases
F. Writing, start talking about lab project for final grade/science fair

Week 6 September 18
T-Gram negative organisms, oral fecal route, food-borne, clean water
W-Selective differential media, EMB, McConkey, environmental bathrooms
R-Observe, more lecture

Week 7 September 25
T-Food microbiology
W-Yogurt, measure pH start and finish
R-Violet Red Bile and Ground Beef, coliforms
F- Field trip Bueno Foods, Creamland Dairy, Rainbow Bread (may not take people under 18/liability) or Sierra Goat Farms/ makes cheese Goat farms charges $2.50/student, lots of food to eat.

Week 8 October 2
T-Water microbiology
W. MUG, membrane filtration, pathoscreen, BARTS as demo, etc
R HACH kits lecture on Water treatment or environmental micro
F-trip to sewer or Jemez Springs or Rio Grande Nature Center for field work and sampling

Week 9 October 9
review, survey, written mid-term, lab practical
F- possible guest speaker - Randy Buck - Science Fair UNM

Week 10 October 16
T- metabolism
W/R- multiple test media TSA, SIM, Urease, etc
F observe and discuss results

Week 11 - October 23
T-Gram positive diseases, Toxic Shock syndrome, virulence factors
W-MSA. CNA blood, T-soy blood, Skin and throat swabs
R- Observe, more on Gram positive disease

Week 12 - October 30 I willbe out of town October 28 through Nov 2)
maybe Randy Buck should come this week
T-coagulase, DNAase plates
W Guest speaker - infectious diseases ?
R Discuss projects, ideas, goals,

Week 13 - November 7
T-Antibiotic resistance
W- Kirby Bauer Plates
R-Observe, Discuss in Context of outside readings,

Week 14 - November 14
M-F Lab Practical exam, work on unknown
Work on materials needed for project, library work for project

Weeks 15-18
Final Project, lab work, data analysis, write up, science fair poster, oral presentation
Grades based on: T/W/R part (Graded by JYS)
Weekly quiz,probably on R
Lab practical exam
Participation
Unknown report project
Final Project

Grades of M/F part Graded by (RC)
1. Lab reports best four grades out of five reports, report is due the Friday of the following week after completing the lab, they may write one report per lab group or one per person.
2. written and presentation portion of lab project

3. improvement on computer and library skills, include InterNet

Syllabus for the Spring Term

Janet Shagam, Ph.D.
Phone @ TVI 224-3597
e-mail janetshaga@ aol.com

The first few weeks of this course will be devoted to basic chemistry, biological chemistry, cell biology and genetics in preparation for various topics in human anatomy and physiology. Each week will be spent in a combination of lecture and lab material. There will be weekly quizzes, two exams (1 written/1 lab practical) and one lab report for this portion of the class. The lab report is due one week after completion of the lab. Completion of the Science Fair projects in time for the HHS fair is required.

You are expected to come to class. Should you miss class due to illness or a "Highland " excuse you are expected to arrange make-up work with the instructor. However the best way to keep up in the event of an absence is to call another student in the class.

Week 1
General Cell Biology and Chemistry
Work on Science Fair Projects

Week 2
Chemistry
Lab: Acids, Bases, Buffers, pH
pass in computer plotted graph and table of data
Lab: Standard Curve, use of Spectrophotometer
pass in standard curve (plotted on the computer) and determination of unknown

Week 3
Chemistry continued if necessary
Cell biology - membranes
Lab: Diffusion
Lab: Effect of Solute concentration on Osmosis
lab report - choice 1

Week 4
Cell biology - metabolism
Lab: Fermentation
Lab: Enzymes, Liver catalase
lab report- choice 2

Week 5
Cell biology genetics
Lab: DNA model, mitosis slides
Lab: Genetic corn, dihybrid cross

Syllabus for the Spring Term, cont.
Rusty Cook
Phone 265-3711, ext 459

Week 6
Final preparation for Science Fair - final draft of paper and abstract
final assembly of display
put project in assigned location on Thurs. afternoon

Week 7
Body Organization - Chapter 7
Lab: Tissues
Lab: Body Organization and Terminology
Research outlines due; need at least three references
Quiz on body organization

Week 8
Skeletal System - Chapter 8
Lab: Macroscopic Structure of Bone
Lab: Organization of the Skeleton
Lab: The Skull
Lab: Vertebral Column and Thoracic Cage

Week 9
Skeletal System, cont.
Lab: Pectoral Girdle and Upper Limb
Lab: Pelvic Girdle and Lower Limb
Lab: Joints
Quiz on skeletal system

Week 10
Muscular System - Chapter 9
Lab: Muscle Tissues and Skeletal Muscle Structure
Lab: Muscles of the Face and Head
Lab: Muscles of the Chest, Shoulder, and Arm

Week 11
Lab: Muscles of the Abdominal Wall
Lab: Muscles of the Thigh and Leg
Quiz on muscular system

Week 12
Nervous System - Chapter 10
Lab: Nerve Tissue
Lab: The Reflex Arc and Reflexes

Lab: The Meninges and Spinal Cord

Week 13
Lab: The Brain and Cranial Nerves
Lab: Dissection of the Sheep Brain
Quiz on nervous system
Research paper rough drafts due

(Spring Break)

Week 14
Cardiovascular System - Chapter 16
Lab: Structure of the Heart
Lab: The Cardiac Cycle
Lab: Blood Vessels

Week 15
Anatomy Lab at T-V1

Week 16
Lab: Pulse and Blood Pressure
Lab: Major Arteries and Veins
Quiz on Cardiovascular system
Digestion and Nutrition - Chapter 13
Lab: Organs of the Digestive System
Lab: Actions of a Digestive Enzyme

Week 17
Quiz on digestion and nutrition
Reproductive Systems and Pregnancy - Chapter 20
Lab: Male Reproductive System
Lab: Female Reproductive System
Lab: Development of the Fetus, Labor and Delivery
Quiz on reproductive systems

Week 18
Evolution and Human History (handouts)
Labs
Quiz on evolution and human history
Research papers due

Week 19
Review
Final Exam
Seniors final journals

Week 20
Underclass final journals
Clean up lab and put everything away

Appendix B: Examples of Pre/Post-tests

Perkins Project
A Survey of Applied Medical Science
1994-95 Pre/Post Exam

The purpose of this test is to tell us what you already know about 10 different subject areas that will be covered this semester. If you are not able to answer a question mark it "e" for "don't know". The score you get on this test will not affect your grade in the class. This test, when compared to your final test results, will help us measure what you have learned during the semester.

Using a number, 2 pencil please mark your answers on the answer sheet provided.

Measurement

1. A micron is a unit of: (a) temperature, (b) mass, (c) length, (d) volume (e) don't know.

2. The unit of temperature that is used in the medical lab is degrees: (a) Celsius, (b) Fahrenheit, (c) Kelvin, (d) between room temperature and boiling, (e) don't know.

3. A reasonable approximation for the length of a microscope slide is: (a) 7 meters, (b) 7 centimeters, (c) 70 millimeters, (d) 7 microns, (e) don't know.

4. If you add 1 ml of a solution to 99 ml water, the dilution factor is : (a) 1, (b) 1:1000, (c) 1:100, (d) 1:98, (e) don't know.

5. Which series of numbers is arranged from largest to smallest: (a) 5 cm, 500 mm, 0.5 m, (b) 7.0 l, 7000 ml, 7000000 ul, (c) 5 m, 50 cm, 500 mm, (d) 50 um, 5 mm, 0.5 cm, (e) don't know.

6. If the ocular is 10X and the objective is 40X, the total magnification is: (a) 400X, (b) 50X, (c) 40X, (d) 30X, (e) don't know.

7. The correct abbreviation for milliliter is: (a) mg, (b) ml, (c) ML, (d) ul, (e) don't know.

8. pH is a measure of the : (a) hydrogen ion concentration, (b) temperature of hot acid, (c) solute concentration, (d) pH level, (e) don't know.

9. Laboratory controls are needed to: (a) calibrate laboratory machines, (b) test the accuracy of the test, (c) define a positive reaction, (d) all of the above, (e) don't know.

10. The instruments which measure red blood cell counts use which of the following solutions: (a) blood diluted with water, (b) whole blood, (c) blood diluted with saline, (d) blood diluted with acetic acid, (e) don't know

Safety

11. Where do we dispose of used Petri plates, urine cups and blood cards: (a) biohazard bag, (b) regular trash, (c) sharps container, (d) freezer, (e) don't know.

12. "Amphyl" or "Saniturge" are products used to: (a) disinfect lab bench surfaces, (b) sterilize lab bench surfaces, (c) sterilize our hands after working with pathogens, (d) remove stains, (e) don't know.

13. Pipetting by mouth is: (a) sometimes permitted, (b) permitted when using safe liquids, (c) is never permitted, (d) permitted if you don't have a cold, (e) don't know.

14. Proper attire (clothing) when working in a laboratory includes a: (a) lab coat, shoes that cover the feet, latex gloves and eye protection, (b) sandals and street clothes, (c) sandals, lab coat and latex gloves, (d) sandals, shorts and eye protection, (e) don't know.

15. If you accidentally cut yourself with a slide that has potentially pathogenic material on it you should: (a) wipe the blood on your lab coat and go on working, (b) notify your supervisor and get appropriate medical care, (c) wash your hands and get back to work, (d) do nothing, (e) don't know.

16. The most dangerous and most likely infection that you can acquire in the laboratory is: (a) hepatitis A, (b) hepatitis B, (c) polio, (d) strep throat, (e) don't know.

17. The single best way to prevent the transmission of infectious particles is by: (a) wearing latex gloves, (b) hand washing, (c) cleaning and disinfecting countertops, (d) wearing face shields, (e) don't know.

18. A technician, properly dressed in white pants, labcoat and shoes, prepares to leave the lab for lunch. After washing the lab bench and hands with disinfectant, the technician should also do one other thing before leaving the lab: (a) put on safety goggles, (b) remove labcoat, (c) tie hair back, (d) remove gloves and put them in the labcoat pocket for future use, (e) don't know.

19. Living microbial material, blood and discarded human tissue are all classified as: (a) chemical hazards, (b) biohazards, (c) carcinogens, (d) physical hazards, (e) don't know.

20. The safest way to work in a medical lab is to assume that: (a) potentially dangerous specimens will be labeled, (b) every specimen should be treated as though it may contain potentially infectious particles, (c) healthy people resist infections, (d) most patient samples are safe, (e) don't know.

Techniques and Instrumentation

21. Which objective is used with immersion oil: (a) 10x, (b) 4x, (c) 40X, (d) 100X, (e) don't know.

22. When the magnification increases the : (a) field of view increases, (b) field of view decreases, (c) detail decreases, (d) depth of focus stays the same, (e) don't know.

23. A pipette is used to measure (a) the depth of a hole, (b) small volumes of liquid, (c) the weight of chemicals, (d) the number of cells under a slide, (e) don't know.

24. We use a needle to inoculate a: (a) pour plate, (b) spread plate, (c) streak plate, (d) slant, (e) don't know

25. We cold sterilize plate spreaders using: (a) ice, (b) flaming ethanol, (c) salt, (d) soap and water, (e) don't know.

26. We incubate inoculated Petri plates:(a) agar side up, (b) agar side down, (c) either way, (d) sideways, (e) don't know.

27. Blood is best collected by: (a) draining an old wound, (b) vein puncture, (c) cutting the skin with a razor, (d) removing a piece of tissue, (e) don't know.

28. A centrifuge is used to: (a) collect donor blood, (b) remove particulate, bacteria or cells from blood or urine, (c) store tissue samples, (d) pour agar, (e) don't know.

29. The total concentration of solutes in urine can be determined using a: (a) pipette, (b) centrifuge, (c) refractometer, (d) hemacytometer, (e) don't know.

30. The proper technique for using a dipstick to measure chemicals in urine is to remove excess urine from the stick after dipping because: (a) urine will get on your fingers, (b) reagents will run over to other test pads and affect the results, (c) reaction times will take longer, (d) excess urine makes the test pad change to the wrong color, (e) don't know.

Microbiology

31. A dilution series and plate count gives us information concerning the: (a) type of bacteria is a sample, (b) number of bacteria in a sample, (c) ratio between red and white blood cells, (d) sedimentation rate, (e) don't know.

32. Gram positive cocci at 1000x magnification are: (a) pink rods, (b) purple rods, (c) pink spheres, (d) purple spheres, (e) don't know.

33. The presence of acid fast organisms in a sample indicates the patient may have: (a) tuberculosis, (b) polio, (c) strep throat, (d) syphilis, (e) don't know.

34. Gram negative coliforms are isolated and selected using: (a) blood agar, (b) EMB agar, (c) T-SOY agar, (d) MSA agar, (e) don't know.

35. The appearance of beta-hemolysis on blood agar is: (a) opaque pink, (b) green, (c) clear amber, (d) purple, (e) don't know.

36. Coliform bacteria are: (a) generally found in the throat and on the skin, (b) isolated on MSA agar, (c) found in the intestines and can cause food and water borne disease, (d) not pathogenic, (e) don't know.

37. *Staphylococci* are generally found: (a) in the soil, (b) on the skin, (c) in the gut, (d) in water, (e) don't know.

38. Gram positive organisms are:(a) sensitive to penicillin, (b) insensitive to penicillin, (c) are treated with aspirin, (d) are not treated with antibiotics, (e) don't know.

39. Drug resistant bacteria are: (a) insensitive to usual antibiotic treatments, (b) like viruses, (c) not found in nature, (d) always man-made, (e) don't know.

40. Bacteria are: (a) the same as human cells, (b) organisms with a nucleus, (c) similar to viruses. (d) single celled organisms without a true nucleus, (e) don't know.

Immunology

41. Antibodies are produced by: (a) red blood cells, (b) B cells, (c) T cells, (d) liver cells, (e) don't know.

42. The function of the immune response is to: (a) prevent allergies, (b) stimulate red blood cell production, (c) protect us against infection, (d) stimulate digestion, (e) don't know.

43. A person who has "type AB" blood can donate to a person who has : (a) type A, (b) type B, (c) type AB, (d) type O, (e) don't know.

44. Techniques based on immunological principles can be used in the lab to: (a) identify pathogens, (b) determine if a patient has had a prior exposure to a pathogen, (c) determine if a patient is using drugs, (d) all of these choices are possible, (e) don't know.

45. A disease that destroys our immune response is: (a) measles, (b) chicken pox, (c) hepatitis, (d) AIDs, (e) don't know.

46. Our primary (first) defense against pathogens is:(a) over the counter drugs, (b) our skin and mucus membranes, (c) macrophages, (d) immune history, (e) don't know.

47. Vaccines: (a) kill viruses, (b) stimulate our immune system to make antibodies, (c) kill bacteria, (d) are similar to antibiotics, (e) don't know.

48. ELISA tests allow us to: (a) test for the presence of antibodies in body fluids, (b) test for the presence of antigens in body fluids, (c) test for the presence of drugs in body fluids, (d) all of the above, (e) don't know.

49. It is important to be vaccinated against diseases such as measles and polio to: (a) prevent the spread of disease, (b) protect those people who can not be vaccinated, (c) prevent birth defects and other disabilities, (d) all of the above, (e) don't know.

50. The use of antibodies against specific blood type markers allows us to: (a) identify HIV contaminated blood, (b) determine the specimen blood type, (c) test for iron deficiency, (d) identify hepatitis antibodies, (e) don't know.

Tissues

51. A histologist studies: (a) bacteria, (b) tissues, (c) viruses, (d) diseases, (e) don't know.

52. The function of epithelial tissue is: (a) contraction, (b) barrier, (c). sense neural stimuli, (d) transport oxygen to other tissues, (e) don't know.

53. Exposure to alcohol and other drugs is known to cause: (a) changes in the appearance of liver connective tissue, (b) bone nodules, (c) bacterial infections, (d) measles, (e) don't know.

54. The function of muscle tissue is: (a) contraction, (b) barrier, (c) sense neural stimuli, (d) transport oxygen to other tissues, (e) don't know.

55. One of the first effects of smoking on the lung is: (a) cancer, (b) permanent changes in the epithelium, (c) immobilization and destruction of cilia, (d) heart attack, (e) don't know.

56. Adipose tissue is: (a) fat, (b) muscle, (c) nerves, (d) bone, (e) don't know.

57. Blood may be found in the urine for the following reasons: (a) damage to the glomerulus of the kidney, (b) strenuous exercise prior to urine collection, (c) kidney stones, (d) all of the above, (e) don't know.

58. Hemoglobinuria may be the result of the following: (a) high RBC count in the blood, (b) blood transfusion reaction, (c) vitamins with iron, (d) low blood pressure, (e) don't know.

59. The functional part of the kidney is the: (a) renal pelvis, (b) capsule, (c) nephron, (d) renal artery, (e) don't know.

60. Oval fat bodies are: (a) squamous epithelial cells which contain lipids, (b) renal tubular epithelial cells which contain lipids, (c) free-floating fat droplets, (d) white blood cells which contain lipids, (e) don't know.

Calculations and Quality Control

61. If we count 47 bacterial colonies on a plate that was diluted $1x10^{-5}$, how many bacteria are there per ml original sample? (a) 475, (b) 0.00047, (c) 4700000, (d) 235, (e) don't know.

62. A standard curve is a: (a) graph, (b) tool made out of plastic, (c) ruler, (d) micrometer, (e) don't know.

63. We read standard curves by/with: (a) extrapolation, (b) a microscope, (c) interpolation, (d) a magnifying glass, (e) don't know.

64. The closeness of a test value to the actual value is referred to as: (a) reliability, (b) precision, (c) reproducibility, (d) accuracy, (e) don't know.

65. The correct formula for solving proportion problems is: (a) $(V_1)(C_1)=(V_2)(C_2)$, (b) $V_1 = (C_1)(C_2)/V_2$, (c) $V_1C_1 - V_1C_1$, (d) $V_1C_1+V_2C_2$, (e) don't know.

66. We have a stock solution of 50% HCl stored in a 1 liter bottle on the shelf of the safety cabinet. How many ml of the stock solution do we need to make 50 ml of a 10% working solution: (a) 10, (b) 100, (c) 1, (d) 5, (e) don't know.

67. We need 0.5 liter of 70% ethanol. How many ml of 90% ethanol are required to make this solution: (a) 642, (b) 389, (c) 0.642, (d) 0.389, (e) don't know.

68. You are making a serial dilution of a bacterial stock solution with sterile saline. You start by taking 1 ml of the bacterial stock solution and adding it to 99.0 ml sterile saline. After mixing, you transfer 1 ml of this solution to another 99.0 ml sterile saline bottle. If this process is repeated two more times what is the bacterial dilution factor of the fourth bottle: (a) 1:100, (b) 1:1000, (c) 1:10,000, (d) 1: 100,000,000, (e) don't know.

69. A blood sample is diluted 1/200. You count 300 cells in the diluted sample. How many cells are there in the undiluted blood sample: (a) 600, (b) 6,000, (c) 60,000, (d) 50,000, (e) don't know.

70. A solution that has a pH of 5.5 is: (a) acidic, (b) basic, (c) warm, (d) neutral, (e) don't know.

Urinalysis

71. Urine specimens should be analyzed as soon as possible after collection. If urine specimens are allowed to stand at room temperature for an excessive mount of time the urine pH will become alkaline because of the bacterial decomposition of: (a) glucose, (b) urea, (c) ketones, (d) protein, (e) don't know.

72. A urine specimen the exhibits a yellow foam when shaken should be suspected of having an increased concentration of: (a) glucose, (b) ketones, (c) bilirubin, (d) nitrate, (e) don't know.

73. The reagent test strip used for the detection of protein in urine are most reactive to the presence of: (a) albumin, (b) hemoglobin, (c) gamma globulins, (d) lysozyme, (e) don't know.

74. Nitrite in a urine sample suggests the presence of:(a) red blood cells, (b) white blood cells, (c) bacteria, (d) ammonia, (e) don't know.

75. Which of the following crystals may be found in normal urine: (a) cystine, (b) cholesterol, (c) calcium oxalate, (d) leucine, (e) don't know.

76. The first morning urine specimen is the most desirable specimen for a routine urinalysis because it is: (a) the most dilute specimen of the day, (b) least likely to be contaminated by bacteria, (c) most likely to contain protein, (d) most concentrated specimen of the day, (e) don't know.

77. The part of the kidney in which there is selective retention and excretion of various substances as well as the concentration of urine is the: (a) glomerulus, (b) Bowman's capsule, (c) renal tubules, (d) ureter, (e) don't know.

78. If a urine specimen is left a room temperature for several hours, which of the following changes may occur: (a) multiplication of bacteria, (b) an increase in glucose, (c) production of uric acid, (d) an increase in ketones, (e) don't know.

79. To preserve the sensitivity of the urine test strips it is necessary that the strips be: (a) used within 1 year after opening, (b) kept in a loosely capped container, (c) protected from heat, (d) stored in a special dark container, (e) don't know.

80. The type of WBC's that are most frequently found when there is an infection of the urinary system are: (a) eosinophils, (b) lymphocytes, (c) neutrophils, (d) basophils, (d) don't know.

Medical Technology in Patient Care and Careers in Medical Technology

81. The voluntary process by which an agency evaluates a medical laboratory technician program and recognizes that it has met certain preset standards is: (a) accreditation, (b) certification, (c) licensure, (d) registration, (e) don't know.

82. The purpose of the clinical laboratory is to: (a) recommend therapy for the patient, (b) be a full service diagnostic resource for the doctor, (c) develop the cheapest and most effective therapy for the patient, (d) obtain specimens and perform analyses that will help the doctor in the diagnosis, (e) don't know.

83. Laboratories are accredited by which of the following agency(s): (a) NAACLS, (b) NCCLS, (c) ASCP, (d) OSHA, (e) don't know.

84. A prefix in a medical term: (a) describes a condition, (b) changes the meaning of the root word to make it more specific, (c) makes a word easier to pronounce, (d) puts the word in the correct grammatical context, (e) don't know.

85. In which laboratory department where you would most likely store and test blood for patient transfusions: (a) microbiology, (b) histology, (c) immunohematology, (d) cytology, (e) don't know.

86. The laboratory department where you would most likely test blood for bacteria is: (a) hematology, (b) immunology, (c) cytology, (d) microbiology, (e) don't know.

87. Medical laboratory technicians must compete the following to become certified: (a) an academic program, (b) a clinical experience, (c) a passing score on a comprehensive national exam, (d) all of the above, (e) don't know.

88. Laboratory personnel are certified by the following organization: (a) NAACLS, (b) ASCLS, (c) ASCP, (d) all of the above, (e) don't know.

89. After completion of the MLT program at T-VI, graduates receive:
(a) a certificate, (b) an associate degree, (c) a baccalaureate degree, (d) a recognition pin, (e) don't know.

90. Patient laboratory testing results may be discussed with the following: (a) the patient, (b) the patient's doctor, (c) family members of the patient, (d) your family, (e) don't know.

Health Issues

91. The route of transmission for diseases such as polio, hepatitis A, gastroenteritis is: (a) inhaled droplets, (b) oral-fecal, (c) direct contact, (d) fomites, (e) don't know.

92. Diseases that are caused by viruses include: (a) strep throat and polio, (b) hepatitis and strep throat, (c) gonorrhea and syphilis, (d) AIDs and polio, (e) don't know.

93. *Staphylococcus aureus* is a: (a) bacterium commonly found on the skin and can cause food poisoning, (b) virus, (c) bacterium that primarily found in sewer water, (d) bacterium that produces spores, (e) don't know.

94. AIDs is a disease caused by: (a) many different organisms, (b) a virus, (c) a bacterium, (d) poor diet, (e) don't know.

95. AIDs is a disease that is transmitted by (a) sexual contact, (b) use of contaminated needles, (c) use of contaminated blood products, (d) a, b, and c, (d) don't know.

96. Vaccines protect us against disease by: (a) acting like a drug, (b) stimulating our immune system to make antibodies against the disease, (c) making us slightly sick, (d) making us more careful, (e) don't know.

97. We may take penicillin when we have a strep throat because: (a) *Streptococcus pyogenes* is Gram positive, (b) *Streptococcus pyogenes* is Gram negative, (c) penicillin works against all bacteria, (d) it is an inexpensive drug, (e) don't know.

98. Bacteria in urine is: (a) normal, (b) indicates we have eaten bad food, (c) indicates a bladder infection, (d) indicates that we have a cold, (e) don't know.

99. The evaluation of protein in urine is: (a) the single best indicator of kidney disease, (b) of limited use, (c) second in importance following urine odor, (d) the single best indicator of liver function, (e) don't know.

100. We need iron in our diet to: (a) make strong bones, (b) make hemoglobin, (c) loose weight, (d) prevent bacterial infections, (e) don't know.

Perkins Project
A Survey of Applied Medical Science
Pre-Exam

The purpose of this test is to tell us what you already know about various subject areas that will be covered this semester. If you are not able to answer a question mark it "e" for "don't know". The score you get on this test will not affect your grade in the class. This test, when compared to your final test results, will help us measure what you have learned during the semester.

Using a number, 2 pencil please mark your answers on the answer sheet provided.

Measurement

1. A micron is a unit of: (a) temperature, (b) mass, (c) length, (d) volume (e) don't know.

2. The unit of temperature that is used in the medical lab is degrees: (a) Celsius, (b) Fahrenheit, (c) Kelvin, (d) between room temperature and boiling, (e) don't know.

3. A reasonable approximation for the length of a microscope slide is: (a) 7 meters, (b) 7 centimeters, (c) 70 millimeters, (d) 7 microns, (e) don't know.

4. Which series of numbers is arranged from largest to smallest: (a) 5 cm, 500 mm, 0.5 m, (b) 7.0 l, 7000 ml, 7000000 ul, (c) 5 m, 50 cm, 500 mm, (d) 50 um, 5 mm, 0.5 cm, (e) don't know.

5. If the ocular is 10X and the objective is 40X, the total magnification is: (a) 400X, (b) 50X, (c) 40X, (d) 30X, (e) don't know.

6. The correct abbreviation for milliliter is: (a) mg, (b) ml, (c) ML, (d) ul, (e) don't know.

7. pH is a measure of the : (a) hydrogen ion concentration, (b) temperature of hot acid, (c) solute concentration, (d) pH level, (e) don't know.

Safety

8. Where do we dispose of used Petri plates, latex gloves and plastic pipettes: (a) biohazard bag, (b) regular trash, (c) sharps container, (d) freezer, (e) don't know.

9. "Amphyl" or "Saniturge" are products used to: (a) disinfect lab bench surfaces, (b) sterilize lab bench surfaces, (c) sterilize our hands after working with pathogens, (d) remove stains, (e) don't know.

10. Pipetting by mouth is: (a) sometimes permitted, (b) permitted when using safe liquids, (c) is never permitted, (d) permitted if you don't have a cold, (e) don't know.

11. Proper attire (clothing) when working in a laboratory includes a: (a) lab coat, shoes that cover the feet, latex gloves and eye protection, (b) sandals and street clothes, (c) sandals, lab coat and latex gloves, (d) sandals, shorts and eye protection, (e) don't know.

12. If you accidentally cut yourself with a slide that has potentially pathogenic material on it you should: (a) wipe the blood on your lab coat and go on working, (b) notify your supervisor and get appropriate medical care, (c) wash your hands and get back to work, (d) do nothing, (e) don't know.

13. The most likely infection that you can acquire in the laboratory is: (a) AIDs, (b) hepatitis B, (c) polio, (d) strep throat, (e) don't know.

14. The single best way to prevent the transmission of infectious particles is by: (a) wearing latex gloves, (b) hand washing, (c) cleaning and disinfecting countertops, (d) wearing face shields, (e) don't know.

15. Living microbial material, blood and discarded human tissue are all classified as: (a) chemical hazards, (b) biohazards, (c) carcinogens, (d) physical hazards, (e) don't know.

16. The safest way to work in a medical lab is to assume that: (a) potentially dangerous specimens will be labeled, (b) every specimen should be treated as though it may contain potentially infectious particles, (c) healthy people resist infections, (d) most patient samples are safe, (e) don't know.

Techniques and Instrumentation

17. The objective used with immersion oil is: (a) 10x, (b) 4x, (c) 40X, (d) 100X, (e) don't know.

18. When the magnification increases the : (a) field of view increases, (b) field of view decreases, (c) detail decreases, (d) depth of focus stays the same, (e) don't know.

19. A pipette is used to measure (a) the depth of a hole, (b) small volumes of liquid, (c) the weight of chemicals, (d) the number of cells under a slide, (e) don't know.

20. We use a needle to inoculate a: (a) pour plate, (b) spread plate, (c) streak plate, (d) slant, (e) don't know

21. We cold sterilize plate spreaders using: (a) ice, (b) flaming ethanol, (c) salt, (d) soap and water, (e) don't know.

22. We incubate inoculated Petri plates:(a) agar side up, (b) agar side down, (c) either way, (d) sideways, (e) don't know.

Microbiology General

23. A dilution series and plate count gives us information concerning the: (a) type of bacteria is a sample, (b) number of bacteria in a sample, (c) ratio between red and white blood cells, (d) sedimentation rate, (e) don't know.

24. Gram positive cocci at 1000x magnification are: (a) pink rods, (b) purple rods, (c) pink spheres, (d) purple spheres, (e) don't know.

25. The presence of acid fast organisms in a sample indicates the patient may have: (a) tuberculosis, (b) polio, (c) strep throat, (d) syphilis, (e) don't know.

26. Gram negative coliforms are isolated and selected using: (a) blood agar, (b) EMB agar, (c) T-SOY agar, (d) MSA agar, (e) don't know.

27. The appearance of beta-hemolysis on blood agar is: (a) opaque pink, (b) green, (c) clear amber, (d) purple, (e) don't know.

28. Coliform bacteria are: (a) generally found in the throat and on the skin, (b) isolated on MSA agar, (c) found in the intestines and can cause food and water borne disease, (d) not pathogenic, (e) don't know.

29. *Staphylococci* are generally found: (a) in the soil, (b) on the skin, (c) in the gut, (d) in water, (e) don't know.

30. Gram positive organisms are generally:(a) sensitive to penicillin, (b) insensitive to penicillin, (c) are treated with aspirin, (d) are not treated with antibiotics, (e) don't know.

31. Drug resistant bacteria are: (a) insensitive to usual antibiotic treatments, (b) like viruses, (c) not found in nature, (d) always man-made, (e) don't know.

32. Bacteria are: (a) the same as human cells, (b) organisms with a nucleus, (c) similar to viruses. (d) single celled organisms without a true nucleus, (e) don't know.

Calculations

33. If we count 47 bacterial colonies on a plate that was diluted $1x10^{-5}$, how many bacteria are there per ml original sample? (a) 475, (b) 0.00047, (c) 4700000, (d) 235, (e) don't know.

34. A standard curve is a: (a) graph, (b) tool made out of plastic, (c) ruler, (d) micrometer, (e) don't know.

35. We read standard curves by/with: (a) extrapolation, (b) a microscope, (c) interpolation, (d) a magnifying glass, (e) don't know.

36. You start by taking 1 ml of the bacterial stock solution and adding it to 99.0 ml sterile saline. After mixing, you transfer 1 ml of this solution to another 99.0 ml sterile saline bottle. If this process is repeated two more times what is the bacterial dilution factor of the fourth bottle: (a) 1:100, (b) 1:1000, (c) 1:10,000, (d) 1: 100,000,000, (e) don't know.

37. A solution that has a pH of 5.5 is: (a) acidic, (b) basic, (c) warm, (d) neutral, (e) don't know.

Microbiology - Health Issues

38. The route of transmission for diseases such as polio, hepatitis A, gastroenteritis is: (a) inhaled droplets, (b) oral-fecal, (c) direct contact, (d) fomites, (e) don't know.

39. Diseases that are caused by viruses include: (a) strep throat and polio, (b) hepatitis and strep throat, (c) gonorrhea and syphilis, (d) AIDs and polio, (e) don't know.

40. *Staphylococcus aureus* is a: (a) bacterium commonly found on the skin and can cause food poisoning, (b) virus, (c) bacterium that primarily found in sewer water, (d) bacterium that produces spores, (e) don't know.

41. AIDs is a disease caused by: (a) many different organisms, (b) a virus, (c) a bacterium, (d) poor diet, (e) don't know.

42. AIDs is a disease that is transmitted by (a) sexual contact, (b) use of contaminated needles, (c) use of contaminated blood products, (d) a, b, and c, (d) don't know.

43. Vaccines protect us against disease by: (a) acting like a drug, (b) stimulating our immune system to make antibodies against the disease, (c) making us slightly sick, (d) making us more careful, (e) don't know.

44. We may take penicillin when we have a strep throat because: (a) *Streptococcus pyogenes* is Gram positive, (b) *Streptococcus pyogenes* is Gram negative, (c) penicillin works against all bacteria, (d) it is an inexpensive drug, (e) don't know.

45. It is difficult to treat viral diseases because viruses: (a) are small, (b) are the same as bacteria, (c) use host cell cell structures for replication, (d) don't used host cell structures for replication, (e) don't know.

46. Emergent diseases are the result of: (a) environmental changes that may alter host range and competition, (b) creation of new pathogens, (c) lack of health care services, (d) primative living conditions, (e) don't know.

47. An example of an emergent disease is: (a) Hantavirus, (b) Ebola, (c) drug resistant *Strep, Staph* and *Tuberculosis,* (d) all of the above, (e) don't know.

48. The purpose of bacteria on our planet is to: (a) recycle nutrients, (b) make us sick, (c) make bad oders, (d) make cheese, (e) don't know.

49. The appearance of a beta hemolytic reaction on a blood plate indicates that the patient: (a) has pnumonia, (b) is healthy, (c) has strep throat, (d) has a staph infection, (e) don't know.

50. The presence of red colonies on McConkey agar indicates that the inoculating sample is: (a) normal, (b) contains coliforms, (c) contains *Staph aureus*, (d) red, (e) don't know.

A Survey of Applied Medical Science
Pre-Exam - Spring Term

The purpose of this test is to tell us what you already know about various subject areas that will be covered this semester. If you are not able to answer a question mark it "e" for "don't know". The score you get on this test will not affect your grade in the class. This test, when compared to your final test results, will help us measure what you have learned during the semester.

General Cell Physiology

1. What **isn't** a characteristic of a living organism: (a) absorption, (b) growth, (c) responsiveness, (d) none of the above, (e) don't know.

2. Cell reproduction requires: (a) energy use, (b) cell division, (c) DNA replication, (d) all of the above, (e) don't know.

3. The most abundant chemical substance in the body is: (a) water, (b) salt, (c) carbohydrates, (d) food, (e) don't know.

4. The process by which organisms maintain temperature, blood pressure etc. is known as: (a) osmosis, (b) homeostasis, (c) digestion, (d) diffusion, (e) don't know.

5. An organelle is a/an: (a) tissue such as liver, (b) type of cell such as red blood cells, (c) sub-cellular structure such as the mitochondria, (d) organ system such as the circulatory system, (e) don't know.

6. The process by which energy in chemical bonds is stored or used is known as: (a) physiology, (b) metabolism, (c) growth, (d) regulation, (e) don't know.

7. The function of the ribosome is (a) transcription, (b) translation, (c) ATP synthesis, (d) photosynthesis, (e) don't know.

General Chemistry

8. An example of a compound is: (a) oxygen, (b) nitrogen, (c) salt, (d) glucose, (e) don't know.

9. A substance that is in solution is known as a: (a) solute, (b) solvent, (c) reactant, (d) product, (e) don't know.

10. pH is a measure of (a) acidity, (b) alkalinity, (c) hydrogen ion concentration, (d) strength, (e) don't know.

11. The monomeric unit of a protein is: (a) nucleotide, (b) amino acid, (c) glucose, (d) fatty acid, (e) don't know.

12. A protein that has lost its functional shape is known as: (a) denatured, (b) altered, (c) waste products, (d) stripped, (e) don't know.

13. A buffer is: (a) a sort tissue, (b) an alkaline solution, (c) a solution that resists change in pH, (d) similar to aspirin, (e) don't know.

14. A standard curve: (a) is used to find the concentration of an unknown solution, (b) is a table used to convert temperature scales, (c) is Y=mx+b, (d) doesn't exist, (e) don't know.

15. In the laboratory the standard unit of temperature is degrees: (a) Fahrenheit, (b) Kelvin, (c) Celsius, (d) above zero, (e) don't know.

The Cell

16. An example of a eukaryotic cell is a/an: (a) polio virus, (b) *E. coli*, (c) red blood cell, (d) *Strep pyogenes*, (e) don't know.

17. The role of the plasma membrane is: (a) to regulate transport of solutes, (b) produce areas of sub-cellular specialization, (c) respond to environmental change, (d) all of the above, (e) don't know.

18. Examples of diffusion are: (a) concentration of nutrients in the cytoplasm, (b) movement of water out of a cell, (c) movement of salt into a cell. (d) transport nutrients using porin carrier molecules, (e) don't know.

19. A hypertonic solution is relatively: (a) high in solute, (b) high in solvent, (c) isotonic, (d) warmer, (e) don't know.

20. During interphase the cell is: (a) inactive, (b) replicating DNA only, (c) synthesizing proteins only, (d) both b and c, (e) don't know.

21. Mitosis takes place in: (a) mature egg and sperm cells, (b) somatic cells, (c) bacterial cells, (d) all of the above, (e) don't know.

22. The purpose of mitosis is to: (a) produce haploid cells, (b) make an exact copy of DNA for daughter cells, (c) produce genetic variation, (d) inhibit cancer, (e) don't know.

23. Meiosis takes place in: (a) mature egg and sperm cells, (b) somatic cells, (c) bacterial cells, (d) all of the above, (e) don't know.

Cellular Metabolism

24. Metabolism is regulated by: (a) enzymes, (b) use of product, (c) amount of available reactants, (d) all of the above, (e) don't know.

25. An example of an anabolic reaction is: (a) synthesis of proteins from amino acids, (b) production of glucose from the breakdown of carbohydrates, (c) production of glucose from carbon dioxide and water, (d) Kreb's cycle, (e) don't know.

26. Aerobic metabolic paths require: (a) oxygen, (b) enzymes, (c) substrates, (d) all of the above, (e) don't know.

27. The "keystone molecule" that links glycolysis with respiration and fermentation is: (a) pyruvate, (b) acetyl co-A, (c) CO_2 , (d) glucose, (e) don't know.

28. The role of ATP in metabolism is: (a) to energize molecules, (b) regulate enzymes, (c) create heat, (d) release oxygen, (e) don't know.

29. A gene is: (a) protein, (b) unit of genetic information, (c) found only in sperm cells, (d) an enzyme, (e) don't know.

30. A codon is: (a) a gene, (b) three nucleotides that code for an amino acid, (c) the tRNA code, (d) four protein sub-units that compose hemoglobin, (e) don't know.

31. Fermentation: (a) produces 36 ATP molecules, (b) uses oxygen, (c) produces organic acids and alcohols, (d) only takes place in bacterial cells, (e) don't know.

Skeletal System

32. During growth of a long bone, the site of growth in length is the: (a) marrow, (b) epiphyseal plate, (c) endosteum, (d) periosteum, (e) don't know.

33. The outer surface of bone is covered by a connective tissue layer called the: (a) lamellae, (b) periosteum, (c) endosteum, (d) epiphysis, (e) don't know.

34. Compact bone consists of cells called osteocytes located within spaces in the matrix called: (a) lamellae (b) haversian canals, (c) lacunae, (d) medullary cavities, (e) don't know.

35. Which of the following bones is NOT a part of the axial skeleton: (a) skull, (b) ribs, (c) sternum, (d) clavicle, (e) don't know.

36. The two bones of the skull in which teeth are located are the (a) maxilla and mandible, (b) maxilla and zygomatic, (c) maxilla and frontal, (d) frontal and mandible, (e) don't know.

37. The first seven pairs of ribs that attach directly to the sternum are called: (a) true ribs, (b) false ribs, (c) floating ribs, (d) major ribs, (e) don't know.

38. The pectoral girdle: (a) attaches the lower limb to the body, (b) consists of the clavicle and scapula, (c) is part of the axial skeleton, (d) is attached to the body only where the clavicle attaches to the vertebrae, (e) don't know.

Muscular System

39. Connective tissue that separates muscles and surrounds the epimysium is called: (a) perimysium, (b) endomysium, (c) fascia, (d) fasciculi, (e) don't know.

40. The basic structural and functional unit of the muscle is the (a) fasciculus, (b) fiber, (c) myofibril, (d) sarcomere, (e) don't know.

41. A single motor neuron and all the skeletal muscle fibers it innervates is called a: (a) neuromuscular junction, (b) synaptic cleft. (c) motor unit, (d) synapse, (e) don't know.

42. A muscle fiber will not respond to a stimulus until that stimulus reaches the (a) threshold level, (b) tetany, (c) relaxation level, (d) rigor mortis level, (e) don't know.

43. Slow-twitch muscle fibers: (a) are the predominant type of muscle fibers in the upper limbs, (b) have a richer blood supply than fast-twitch fibers, and contain myoglobin, (c) would be used for activities resulting in anaerobic respiration, (d) fatigue more easily than fast-twitch fibers, (e) don't know.

44. Cardiac muscle: (a) is under involuntary control, (b) has long, cylindrical cells, (c) has many nuclei per cell, (d) has no striations, (e) don't know.

45. Smooth muscle: (a) has no distinct sarcomeres, (b) contracts more slowly than skeletal muscle, (c) may be autorhythmic, (d) does not develop an oxygen debt, (e) don't know.

Nervous System

46. In a neuron, cell processes that receive information and carry it to the cell body are called: (a) dendrites, (b) axons, (c) cell bodies, (d) a myelin sheath, (e) don't know.

47. Neuroglial cells that form a myelin sheath around axons are: (a) microglia, (b) ependymal cells, (c) Schwann cells, (d) oligodendrocytes, (e) don't know.

48. White matter of the nervous system: (a) is formed by nerve cell bodies and their dendrites, (b) forms conduction pathways called nerve tracts, (c) forms the cortex of the brain, (d) forms nuclei deep within the brain, (e) don't know.

49. An action potential occurs: (a) if the membrane potential reaches a threshold value, (b) when negative proteins and ions rapidly enter the cell, (c) when the inside of the cell becomes negative compared to the outside, (d) when there is repolarization, (e) don't know.

50. The part of the brainstem that regulates heart rate, breathing, swallowing, coughing, and sneezing is the: (a) cerebrum, (b) medulla oblongata, (c) pons, (d) midbrain, (e) don't know.

51. The deep groove that separates the right and left cerebral hemispheres is the: (a) longitudinal fissure, (b) lateral sulcus, (c) lateral fissure, (d) infundibulum, (e) don't know.

52. The area of the cerebral cortex (just posterior to the central sulcus) that receives general sensory information such as pain, pressure, and temperature is called the (a) association area, (b) primary motor area, (c) primary somesthetic cortex, (d) premotor area, (e) don't know.

Cardiovascular System

53. The heart is surrounded by the: (a) a pericardial cavity, (b) mediastinum, (c) abdominal cavity, (d) a and b, (e) don't know.

54. The blood vessels that supply blood to the heart tissue are the (a) pulmonary veins, (b) coronary arteries, (c) coronary sinuses, (d) venae cavae, (e) don't know.

55. In a normal heart, when the right ventricle contracts, it forces blood through the: (a) tricuspid valve, (b) bicuspid valve, (c) aortic semilunar valve, (d) pulmonary semilunar valve, (e) don't know.

56. Tachycardia occurs when: (a) the heart rate is less than 60 beats per minute, (b) the heart rate is more than 100 beats per minute, (c) ventricular fibrillation occurs, (d) ectopic beats occur in the atria, (e) don't know.

57. The arteries with walls that are mostly smooth muscle are: (a) medium sized (distributing) arteries, (b) elastic arteries, (c) arterioles, (d) capillaries, (e) don't know.

58. Blood flow through capillaries is regulated by: (a) one-way valves in the veins, (b) precapillary sphincters, (c) skeletal muscle contraction, (d) the tunica intima, (e) don't know.

59. Deposition of material in the walls of arteries to form plaques is called: (a) atherosclerosis, (b) varicose veins, (c) thrombosis, (d) phlebitis, (e) don't know.

60. Which of the following veins is often used as a site for drawing blood? (a) brachial vein, (b) basilica vein, (c) cephalic vein, (d) medial cubital vein, (e) don't know.

Digestive System

61. The living, cellular, calcified tissue in a tooth is the: (a) pulp, (b) alveoli, (c) enamel, (d) dentin, (e) don't know.

62. The esophagus: (a) is a cartilaginous tube, (b) extends from the nasal cavity to the stomach, (c) lies anterior to the trachea, (d) has upper and lower sphincters, (e) don't know.

63. Which of the following structures increase the surface area of the small intestine to allow more efficient digestion and absorption of food? (a) circular folds, (b) villi, (c) microvilli, (d) a, b, and c, (e) don't know.

64. Bile is produced in the liver by: (a) the gall bladder, (b) hepatocytes, (c) hepatic sinusoids, (d) the portal triad, (e) don't know.

65. The pancreas has: (a) an endocrine portion consisting of acini, (b) an exocrine portion consisting of pancreatic islets, (c) the pancreatic duct which carries digestive enzymes from the pancreas, (d) the pancreatic duct which empties into the jejunum, (e) don't know.

66. The major secretions of the cells of the large intestine is: (a) digestive enzymes, (b) hydrochloric acid, (c) mucus, (d) hormones, (e) don't know.

Nutrition and Metabolism

67. Metabolism: (a) is the process that provides energy for doing work in the body, (b) consists of both anabolism and catabolism, (c) requires food, (d) a, b and c, (e) don't know.

68. Vitamins that cannot be produced by the body and must be obtained through the diet are called: (a) provitamins, (b) essential vitamins, (c) fat-soluble vitamins, (d) hypervitamins, (e) don't know.

69. The carbohydrate that is carried to the cells that require energy is: (a) sucrose, (b) fructose, (c) starch, (d) glucose, (e) don't know.

70. Emulsification of fats (a) is accomplished by bile salts, (b) increases the size of fat droplets, (c) increases the surface area of fat droplets, (d) prepares fats for digestion by amylase, (e) don't know.

71. Triglycerides: (a) are composed of glycerol attached to 3 amino acids, (b) are the most common type of lipid in the body, (c) are digested by lipase, (d) b and c, (e) don't know.

72. The minerals sodium, potassium, calcium, magnesium and phosphate are moved across the wall of the small intestine by: (a) osmosis, (b) active transport, (c) facilitated diffusion, (d) phagocytosis, (e) don't know.

Reproductive System

73. The process that produces sex cells in both males and females is a special type of cell division called: (a) mitosis, (b) meiosis, (c) duplication, (d) transportation, (e) don't know.

74. The lobules of the testis contain: (a) seminiferous tubules, (b) interstitial cells, (c) the ductus deferens, (d) a and b, (e) don't know.

75. The duct formed by the joining of the ductus deferens and the seminal vesicle duct is called the: (a) seminal duct, (b) urethra, (c) ejaculatory duct, (d) common bile duct, (e) don't know.

76. The prostate gland: (a) has a duct that joins the ductus deferens to form the ejaculatory duct, (b) surrounds the urethra and ejaculatory duct, (c) has many short ducts that join the urethra, (d) a, b and c, (e) don't know.

77. Developing follicles secrete small amounts of the hormone: (a) progesterone, (b) testosterone, (c) FSH, (d) estrogen, (e) don't know.

78. After ovulation, the ruptured follicle is transformed into a glandular structure called the: (a) mature follicle, (b) corpus luteum, (c) corpus albicans, (d) corpus striatum, (e) don't know.

79. Part of which of the following layers of the uterus is sloughed off during menstruation? (a) endometrium, (b) myometrium, (c) serous layer, (d) peritoneum, (e) don't know.

80. During the secretory phase of the menstrual cycle, you would normally expect: (a) the highest levels of progesterone that occur during the menstrual cycle, (b) a follicle present in the ovary that is ready to undergo ovulation, (c) the endometrium is just beginning to develop, (d) a and b, (e) don't know.

Appendix C: 1996 ASM Abstract

Pre-College Microbiology Collaborative Between Albuquerque Technical Vocational Institute and Highland High School.

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Economically and language disadvantaged students at Highland High School (Albuquerque, New Mexico) have been able to participate in a Perkins funded Pre-College Microbiology program since 1994. The purpose of the program is to: encourage students to take science classes while in high school, improve writing and analytical skills, expose students to various health related degree programs at TV-I, broaden interest in health related occupations, learn basic microbiology lab techniques and to increase awareness of various personal and public health issues. Students are exposed to theoretical microbiology in lecture and work on various "hands-on" activities during the lab portion of the class. Reading in the content area, presentation of data and technical writing are addressed in the Technical Writing portion of the program. Guest speakers from various health professions come to class and several field trips are taken each semester. Students are given several independent problems that include: identification of an unknown, microbial analysis of a meat sample, microbial assessment of the school swimming pool area and design and completion of a project of their choice, Evaluation of student progress is accomplished using pre and post tests, written reports, exams, and surveys.